APPENDIX D
CONSTRUCTION QUALITY ASSURANCE PLAN

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BASIS OF DESIGN REPORT
JORGENSEN FORGE EARLY ACTION AREA

Prepared for

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LIST OF ACRONYMS AND ABBREVIATIONS

Action Memo	Action Memorandum for a Non-Time-Critical Removal Action at the Jorgensen Forge Early Action Area of the Lower Duwamish Waterway Superfund Site in Seattle, Washington
Anchor QEA	Anchor QEA, LLC
ARAR	applicable or relevant and appropriate requirement
AOC	Administrative Order on Consent
BODR	Basis of Design Report
Boeing	The Boeing Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHASP	Construction Health and Safety Plan
CIH	Certified Industrial Hygienist
cm	centimeters
CMP	corrugated metal pipes
COC	chemicals of concern
CQA	construction quality assurance
CQAP	Construction Quality Assurance Plan
CQAO	Construction Quality Assurance Officer
CQC	construction quality control
cy	cubic yards
DMU	dredge management unit
DSOA	Duwamish Sediment Other Area
DTM	Digital Terrain Model
EAA	Early Action Area
Ecology	Washington State Department of Ecology
EE/CA	Engineering Evaluation/Cost Analysis
EMJ	Earle M. Jorgensen Company
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
Facility	Jorgensen Forge facility
FSP	Field Sampling Plan

Jorgensen Forge	Jorgensen Forge Corporation
LDW	Lower Duwamish Waterway
MHHW	Mean higher high water
MLLW	Mean lower low water
NTCRA	non-time-critical removal action
OMMP	Operations, Maintenance, and Monitoring Plan
Owner	EMJ and Jorgensen Forge
PCB	polychlorinated biphenyl
PPE	personal protective equipment
QAPP	Quality Assurance and Protection Plan
RAB	Removal action boundary
RACR	Removal Action Completion Report
RAO	Removal Action Objectives
RAWP	Removal Action Work Plan
RCRA	Resource Conservation and Recovery Act
RTK GPS	Real Time Kinematic Global Positioning System
RvAL	removal action level
SOQ	Statement of Qualifications
SOW	Statement of Work
TOC	Total organic carbon
WQMP	Water Quality Monitoring Plan

1 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) has been prepared on behalf of Earle M. Jorgensen Company (EMJ) and Jorgensen Forge Corporation (Jorgensen Forge; herein referred to collectively as the Owner) pursuant to the Administrative Settlement Agreement and Order on Consent for Removal Action Implementation (AOC; U.S. Environmental Protection Agency [EPA] Region 10 Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. 10-2013-0032) and attached Statement of Work (SOW). This CQAP is an appendix to the Basis of Design Report (BODR) Final Design submittal for the cleanup of contaminated sediments and associated bank soils in a portion of the Lower Duwamish Waterway (LDW) Superfund Site adjacent to the Jorgensen Forge facility (Facility) located in Tukwila, King County, Washington (see Figure 1 of the BODR; Jorgensen Forge Early Action Area [EAA]). Construction activities planned as part of the cleanup include in-water dredging and backfilling, shoreline bank excavation and armoring, and transport and off-site disposal of impacted sediments and soils. The cleanup will be conducted as a non-time-critical removal action (NTCRA) in accordance with EPA's selected cleanup alternative documented in the *Action Memorandum for a Non-Time-Critical Removal Action at the Jorgensen Forge Early Action Area of the Lower Duwamish Waterway Superfund Site in Seattle, Washington* (Action Memo; EPA 2011a) and detailed in the *Final Engineering Evaluation/Cost Analysis [EE/CA] – Jorgensen Forge Facility, 8531 East Marginal Way South, Seattle, Washington* (Anchor QEA 2011).

The purpose of the CQAP is to detail the sediment removal verification methods and the approach to quality assurance during construction activities within the removal action boundary (RAB), including compliance with applicable or relevant and appropriate requirements (ARARs). To accomplish this purpose, this document identifies the quality assurance program during implementation of the construction activities to ensure the activities are performed in accordance with the Final Design documents. Additionally, this CQAP describes the methods used to measure compliance with performance objectives.

As described in Section 1.1 of the BODR, The Boeing Company (Boeing) is conducting an interim corrective action under the Resource Conservation and Recovery Act (RCRA) adjacent to the Boeing Plant 2 Facility in the area immediately adjacent and downstream

from the RAB (Figure 1). In addition, Jorgensen Forge and Boeing are currently planning to perform a removal action under a Second Modification to the AOC with the EPA Office of Emergency Response that will include removal of inactive corrugated metal pipes (CMP) and underlying soils with polychlorinated biphenyls (PCBs) located in the northwest corner of the Jorgensen Forge property. This removal action will also be directly adjacent to the RAB shoreline reconfiguration. This CQAP incorporates the necessary information to support successful integration of these adjacent removal actions.

The remainder of this CQAP is organized into the following sections to address the document requirements detailed in the SOW:

- **Section 2 – Definitions and Use of Terms**: Defines terms relative to the Quality Management System, which includes both construction quality control (CQC) and construction quality assurance (CQA).
- **Section 3 – Project Organization and Responsibilities**: Presents the roles and responsibilities of the parties involved in the sediment remediation, including EPA and other agencies.
- **Section 4 – Contractor and Construction Quality Assurance Officer (CQAO) Qualifications**: Describes the qualifications and experience required for the Contractor and any selected subcontractors, as well as the qualifications of the CQAO and supporting inspection personnel.
- **Section 5 – Quality Assurance Program**: Describes the performance objectives and criteria, quality assurance measures, inspection and verification activities, and contingency actions for each construction activity.
- **Section 6 – Documentation and Reporting**: Describes the reporting requirements for CQA activities. These requirements include daily and weekly summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, and final documentation. A description of the provisions for final storage of all records consistent with the requirements of the AOC is also included in this section.

2 DEFINITIONS AND USE OF TERMS

CQC and CQA are defined as follows:

- CQC is the planned system of inspections and testing by the General Contractor's (Contractor's) team (or their subcontractors) to monitor and control the characteristics of an item, service, removal, or installation in relation to design requirements. The CQC activities provide for a collection of construction condition measurements.
- CQA is the planned and systematic means and actions that provide the Owner adequate confidence that materials, dredging and shoreline reconfiguration, backfill and armor layer placement, and transport and off-site disposal activities meet or exceed design criteria and requirements. The CQA activities provide for collection of mutual and independent third-party measurements of construction conditions, as well as review and confirmation of the quality of data collected as part of the CQC activities.

In the context of this document, CQC refers to the following:

- Those actions taken by the Contractor's team (or their subcontractors) to determine compliance of the various components of the dredging and shoreline reconfiguration, backfilling and armor layer placement, and transport and off-site disposal activities with the requirements of the approved design.

In the context of this document, CQA refers to the following:

- Means and actions employed by the Owner to independently assess conformity of the various components of the dredging and shoreline reconfiguration, backfilling and armor layer placement, and transport and off-site disposal activities with the requirements of the approved design.

3 PROJECT ORGANIZATION AND RESPONSIBILITIES

The roles and responsibilities of the parties involved in the removal action activities are described below and presented in Figure 1.

3.1 U.S. Environmental Protection Agency and Other Agencies

EPA is the regulatory authority and is the responsible agency for overseeing and authorizing the removal action activities described herein. In this capacity, EPA will review information described in the attached BODR and Construction Specifications and Drawings, and this CQAP for consistency with the Removal Action Objectives (RAO), the AOC, and ARARs. The EPA Project Coordinator, or a designee, will exercise project oversight for EPA, coordinate comments developed by EPA and other agencies, and communicate agency observations with the Owner and the Project Engineer. The EPA Project Coordinator shall notify the Owner if they identify any concerns regarding the implementation of the removal action. The Owner, or a designated representative, will propose to EPA and the EPA Project Coordinator response measures or recommendations, as appropriate. The EPA, as appropriate, will make final decisions to resolve such issues or problems that may change the removal action scope.

EPA will work cooperatively with other government agencies, and other federal agencies, as necessary. The other agencies will continue to review documents and participate in decision making related to the removal action, as necessary and facilitated by EPA. Other agencies will provide their comments to the EPA Project Coordinator for communication to the Owner.

3.2 Owner

The Owner is ultimately responsible for implementing the removal action in accordance with the AOC and SOW. The Owner, or a designated representative, will implement the CQAP, review Contractor work products, and be the point of contact with EPA.

3.3 Project Engineer

The Project Engineer is responsible for two main tasks. First, the Project Engineer is responsible for preparing the design of the removal action such that successful implementation of the design will result in achieving the AOC and construction activity-specific objectives and requirements.

Additionally, the Project Engineer will provide consultation and observations during construction to assist with implementation of the removal action in conformance with the EPA-approved design documents. During implementation of the removal action, potentially noncompliant construction activities will be referred to the Project Engineer. The Project Engineer is responsible for determining whether the allegedly noncompliant construction is acceptable within the design, unacceptable, or acceptable with a design modification. EPA will have final authority to approve design modifications proposed by the Project Engineer.

3.4 Construction Quality Assurance Officer

The CQAO will be responsible for overseeing the implementation of the CQAP. In overseeing implementation of the CQAP, the CQAO is responsible for monitoring construction performance for compliance with construction performance standards and design requirements during implementation of the removal action, and is responsible for overseeing the required inspection and verification activities. The CQAO will review documentation submitted by and work completed by the Contractor for adherence to performance standards and design requirements. The CQAO will be sufficiently familiar with the EPA-approved design documents and the construction operations to recognize deviations from those documents. The CQAO will also have the ability to manage and maintain the integrity of the data generated during implementation of the removal action.

The CQAO will be responsible for identifying those field conditions that may warrant deviation from the EPA-approved design documents. In such circumstances, the CQAO will coordinate with the EPA Project Coordinator to identify and agree upon any necessary deviations to meet the overall objectives of the design. Any agreed-upon deviations will be documented in the weekly progress reports to EPA.

The CQAO may use inspectors with the requisite expertise and experience to help perform the duties described above.

3.5 General Contractor

The Contractor will be responsible for implementing the removal action by either performing tasks or contracting with subcontractors. The Contractor is responsible to ensure that the work complies with the requirements of the contract Construction Specifications and Drawings and provides all necessary quality control information.

As part of the removal action implementation, the Contractor will be responsible for developing and implementing the CQC Plan, including the required monitoring, sampling, testing, and reporting needed to implement the project in accordance with the Construction Specifications and Drawings. Independent of the Contractor's quality control program, Jorgensen Forge will implement this CQAP to verify that the removal action is implemented in accordance with the design. In accordance with implementing the removal action construction activities, the Contractor will oversee the development of an Environmental Protection Plan (EPP).

The Contractor will use key personnel to help with the tasks described above, including an on-site superintendent, CQC supervisor, and health and safety manager.

3.5.1 Contractor On-Site Superintendent

Direction of the work for the Contractor will be through an on-site Superintendent who will be responsible for executing the work in full compliance with the Construction Specifications and Drawings. The Superintendent will work to resolve work-related problems and day-to-day project management. The Superintendent may utilize one or more foremen to directly supervise the major construction activities. The Superintendent will exercise supervision over subcontractors, if subcontractors are utilized.

3.5.2 Contractor Construction Quality Control Manager

A CQC Manager will be provided by the Contractor as required in the Construction Specifications. The CQC Manager will develop and implement the CQC Plan through which

the Contractor ensures compliance with the requirements of the Construction Specifications and Drawings. The CQC Plan will identify the duties and responsibilities assigned by the Contractor to the CQC Manager and additional inspectors, as needed to monitor that the removal action is implemented in accordance with the Construction Specifications and Drawings. The CQC Plan will state the chain of command for the CQC team, including identification of responsibilities for each member, to ensure that any actions related to the quality of work will be executed in an accurate and expeditious manner.

3.5.3 Contractor Health and Safety Manager

The Contractor will employ a Health and Safety Manager to develop and implement a Construction Health and Safety Plan (CHASP). The CHASP will contain details of the chain of command and personnel responsibilities, as discussed in the Construction Specifications. The Health and Safety Manager will be required to have the appropriate current federal and state health and safety training necessary to perform the work.

3.6 Subcontractors

The Contractor will either perform construction elements or contract with subcontractors to perform selected phases of the work for which they have special expertise. The subcontractors are responsible to the Contractor for the quality of their work, protection of the environment, CQC Plan, EPP, and CHASP. The subcontractors' principals will each designate a job foreman with responsibility to see that the work is conducted in accordance with the contract requirements and the Construction Specifications and Drawings.

4 CONTRACTOR AND CONSTRUCTION QUALITY ASSURANCE OFFICER QUALIFICATIONS

Qualifications of the CQAO and supporting inspection personnel, including minimum training and experience that will be required, are provided below. Additionally, the qualifications required for the Contractor's firm and personnel are provided.

4.1 Project Manager

The Project Manager will have experience in managing environmental projects of a complexity and magnitude similar to or greater than the removal action project. The Project Manager will be thoroughly familiar with the AOC and SOW, applicable environmental laws, and the requirements of the EPA-approved design documents. The Project Manager will be supported by other personnel, such as an attorney and an engineer, assigned to the project.

4.2 CQAO and Inspector Qualifications

The CQAO will be determined prior to start of work. The CQAO will have an engineering degree and experience managing CERCLA-related construction projects with similar quality assurance requirements. The CQAO will be required to have the appropriate current federal and state health and safety training necessary to perform the work. Additionally, the CQAO will be sufficiently familiar with the EPA-approved design documents and the construction operations to recognize deviations from those documents and operations. The CQAO will also have the ability to manage and maintain the integrity of the data generated during the project. Additional inspectors may be used to help the CQAO. These inspectors will have experience inspecting construction activities for CERCLA-related projects and will have current federal and state health and safety training.

4.3 Contractor Qualifications

The Contractor will be selected through a competitive qualifications-based selection process. Each potential Contractor proposing on the project will be required to provide a Statement of Qualifications (SOQ) to the Owner with its proposal. This will allow the Owner to

determine that the proposer is qualified, in terms of experience and capability, to perform the work.

The Contractor will employ (as part of its permanent organization) senior, knowledgeable, and experienced personnel to oversee the project. The journeyman operators, surveyors, and other Contractor personnel performing key jobs must also have the demonstrated ability and skills to satisfactorily perform their respective assignments.

The CQC Manager, and the Contractor as a whole, must have documented qualifications and experience to perform independent checks on the Contractor's operations as necessary to determine compliance with the Construction Specifications and Drawings. These documented qualifications will be submitted to the Owner for approval prior to identifying a CQC Manager. Additionally, any subcontractors utilized in the work must have demonstrated to the satisfaction of the Owner that they are qualified and have satisfactorily performed the type of work for which they will be engaged. However, responsibility for the subcontractor performance rests with the Contractor. All Contractor and subcontractor personnel working on this project will be required to have current federal and state health and safety training, as applicable to the work they will be doing on this project.

5 QUALITY ASSURANCE PROGRAM

The quality assurance program to be implemented during the removal action is described in this section by construction activity. Specific construction activities to be implemented are described, along with specific performance objectives, performance criteria, quality assurance measures, inspection and verification activities, and contingency actions. Removal action construction elements subject to the quality assurance program include the following:

- Dredging and shoreline bank reconfiguration
- Backfill and armor layer placement

For each of these construction elements, inspection and verification activities will be implemented to confirm performance objectives have been met.

During the removal action, the quality assurance program will progress as follows:

- The Contractor will submit a CQC Plan as detailed in Section 6. The CQC Plan will be subject to Owner approval before removal action field work begins.
- The Contractor will provide documentation to the CQAO to demonstrate that specific components of the EPA-approved design documents have been properly implemented. The Owner, in consultation with the CQAO, will determine whether the components of the removal action are acceptable and complete.
- The Contractor and the CQAO will conduct inspection and verification activities (i.e., sampling, testing, and monitoring) to ensure compliance with the EPA-approved design documents and to ensure that performance objectives have been met. The Owner will have final approval authority for all such inspections and for verifying that corrective actions, if any are warranted, are implemented.

The remainder of this section details each construction element and associated performance objectives and criteria, along with quality assurance measures and specific inspection and verification activities that will be performed to confirm that performance objectives have been met. This section addresses two main construction elements: dredging and shoreline reconfiguration as well as backfill and shoreline armor placement. In addition, this section summarizes the following sediment and bank soil quality monitoring components:

- "Z-layer" sediment sampling to document the sediment quality conditions of the sediment bed below the removal elevations.
- "Z-layer" shoreline bank sampling to document the soil quality conditions of the shoreline bank soil below the excavation elevations.
- Pre- and post-remediation perimeter surface sediment sampling to assess potential construction-related releases from the RAB.

5.1 Dredging and Shoreline Bank Reconfiguration

This section describes the construction oversight activities, including CQC and CQA tasks, which will be undertaken to verify that dredging and shoreline reconfiguration within the RAB has been completed in accordance with the EPA-approved design documents.

5.1.1 Post-dredging and Shoreline Bank Reconfiguration Verification

This section presents post-dredging and shoreline reconfiguration verification plans and performance criteria that will be implemented to verify that the removal action has been completed to the horizontal and vertical extents required by the EPA-approved design documents. Verification of the completion of dredging and shoreline reconfiguration requirements will be performed on a "management unit" basis. A dredge management unit (DMU) is a dredging area within the RAB that will be used for assessing compliance with elevation targets and dredging thickness removal. The purpose of subdividing the RAB into DMUs is to facilitate continuous tracking of the dredging progress and for post-dredge verification purposes while actively dredging in the vicinity of a DMU. The number and orientation of DMUs will be determined in coordination with the contractor based on their means, methods, and construction sequencing. It is anticipated that the DMUs will generally align with the dredging "lanes" depicted on the dredge plan, RAB-specific conditions, and the overall thickness of materials to be removed.

The limits of dredging and shoreline reconfiguration were delineated based on sediment and soil sampling data presented in the BODR. Post-removal surveying will be performed to verify that the limits and extents of removal required by the BODR within a DMU have been achieved prior to placement of the required backfill or slope containment materials.

As part of the CQC program, post-dredging bathymetric surveys will be performed by the Owner using a multi-beam fathometer. In areas where a survey vessel is unable to access, pole soundings or land-based conventional upland survey methods will be employed to supplement the data collection. Survey lines will be set at a 25-foot-grid spacing perpendicular and parallel to the dredge cut where practical. Pole sounding measurements will be taken at a maximum interval of 10 feet along each transect or at a noted break in grade. A Real Time Kinematic Global Positioning System (RTK GPS) will be used to determine the horizontal position of each shallow water survey measurement taken. The Owner will also process the survey data obtained to verify the target elevations have been achieved.

Daily and weekly dredging reports will be prepared to track cumulative volume progress as well as dredging production and coverage. In addition, weekly (during active construction) or monthly (during no active construction) progress reports will be prepared and submitted to EPA.

5.1.2 Post-dredging and Shoreline Bank Reconfiguration Completion Metrics

A three-dimensional surface (i.e., Digital Terrain Model [DTM]) of the DMU will be developed from the CQC survey. Dredging will be considered complete when post-dredging surveys confirm that the required dredge elevation has been achieved over 95 percent of the surface area of a given DMU, with the following additional requirements:

- "High spots" above the required elevations (i.e., up to 5 percent of the area) are relatively isolated (i.e., non-contiguous) and are not the result of intentional bias during implementation
- No more than 1 percent of a given DMU area has an elevation that exceeds the required elevation by greater than 0.5 feet
- None of the area will be permitted to exceed the required elevation by more than 2.0 feet

In the event that post-dredge surveying indicates that required dredge elevations have not been achieved in accordance with the compliance criteria, the Owner will have an option to perform additional post-dredge surveying to check the Contractor survey accuracy and/or

forego additional surveying and perform additional dredging in previously identified non-compliant areas. A subsequent bathymetric survey will be performed and compliance will be reassessed following any additional dredging.

5.2 Backfill and Shoreline Bank Armor Placement

This section describes the construction oversight activities, including CQC and CQA tasks, which will be undertaken to verify that backfill and shoreline bank armor placement has been completed in accordance with the EPA-approved design documents. The CQC and CQA activities will verify that the materials placed are as specified in the Construction Specifications, that they are of the required thicknesses per DMU, and that design elevations have been met.

The backfill is designed to restore the in-water dredging areas to roughly pre-dredge mudline elevations. The shoreline armor materials will stabilize soils and sediments along the shoreline from erosive forces.

5.2.1 Material Verification

This section presents the measurements and analyses that will be performed to demonstrate that the materials used to meet the specifications required in the EPA-approved design documents.

The purpose of the CQA program is to verify that the imported materials conform to the design specifications. As part of the CQA program, the Owner will obtain an approximately 50-pound sample from each borrow source, composed of five subsamples, to confirm that the material gradations are in conformance with the specifications in the EPA-approved design documents. The Owner will perform desktop reviews of particle-size distribution curve submittals, laboratory chemical analysis results submittals, and siderite and carbon certification documentation provided by the manufacturers. The Owner will conduct on-site visual observations of materials on a periodic basis. The Owner will compare the chemical concentrations to the required backfill levels presented in the BODR and Construction Specifications and reject any materials that are above the backfill levels.

5.2.2 Backfill Placement Verification

This section presents verification measurements that will be performed to demonstrate that the backfill material has been placed to the vertical and horizontal limits and extents required by the EPA-approved design documents. Similar to the sediment dredging, verification of the completion of the materials placement will be performed on a "management unit" basis. The number and orientation of DMUs will be determined in coordination with the contractor based on their means, methods, and construction sequencing. It is anticipated that the DMUs will generally align with the dredging "lanes" depicted on the dredge plan, RAB-specific conditions, and the overall thickness of backfill materials to be placed.

After dredging is completed in a DMU, interim backfill material will be placed over the dredged surfaces as soon as possible after dredging is accepted as complete and subject to z-layer sampling (if applicable for a particular DMU as described in Section 5.3.1.1). The 6-inch layer of backfill will be verified using electronic data gathered by the positioning system on backfill placement equipment and field observation of material placement.

For the final backfill layer placement, the CQC and CQA programs involve measuring the thickness of the layer placement to verify that the required thickness has been achieved by surveying the post-backfill surface elevation and comparing that to the post-dredge surface elevation. Additionally, the survey will verify that final target elevations have been met.

Once the backfill material has been placed, post-placement verification surveys will be performed by the Owner using the same surveying methods and spacing described in Section 5.1.1.

As discussed in Section 6, daily and weekly reports will be prepared by the Owner to track cumulative volume placed as well as production and coverage. In accordance with the AOC, weekly (during active construction) or monthly (during no active construction) progress reports will be prepared and submitted to EPA.

5.2.3 Shoreline Bank Armor Layers Placement Verification

This section presents verification measurements that will be performed to demonstrate that the shoreline armor layers have been placed to the vertical and horizontal limits and extents required by the EPA-approved design documents.

As part of the CQC program, the Owner will confirm that the installation of the shoreline armor layers is in compliance with the design requirements. The armor layers range in material type from sand or fine gravel for the filter layer to riprap for the upper layer.

Post-placement verification surveys will be performed by an independent surveyor using the same surveying methods and spacing described in Section 5.1.1 for the filter layer and riprap layer. The habitat substrate layer will be verified using electronic bucket placement verification, visual observation, and spot layer thickness measurements. The post-placement verification surveys will be used in conjunction with layer thickness measurements to document that the required minimum thickness of the filter material (1.5 feet), riprap material (2.5 feet) and habitat substrate (nominal 6 inches) has been achieved.

As discussed in Section 6, daily and weekly reports will be prepared by the Owner to track cumulative volume placed as well as production and coverage. In accordance with the AOC, weekly (during active construction) or monthly (during no active construction) progress reports will be prepared and submitted to EPA.

5.3 Construction Monitoring Sediment and Bank Soil Sampling

This section presents the sampling approach and analysis that will be performed as part of the post-dredge sampling to document that the final post-dredge surface ("z-layer") chemical concentrations are not significantly greater than the total PCB removal action level (RvAL), as well as post-excavation bank sampling to document the nature of the material below the shoreline bank armor layers. In addition, this section presents the sampling approach and analysis that will be performed as part of the perimeter surface sediment monitoring to assess potential construction-related releases from the RAB.

5.3.1 Sampling Objectives and Approach

5.3.1.1 Post-dredge Sediment Z-layer Monitoring

As described in Section 1.3.2 of the Final EE/CA (Anchor QEA 2011), EPA communicated in a meeting on January 27, 2011 that although the EPA-approved removal action alternative includes the removal of the full horizontal and vertical extent of total PCB RvAL exceedances in the RAB and existing data is sufficient to document the sediment quality below these exceedances, EPA will require collection and analysis of the post-dredge surface sediment z-layer samples to fulfill the Washington State Department of Ecology's (Ecology's) request for this information. The z-layer is defined as the 0- to 1-foot interval below the post-dredge surface elevation, prior to backfill placement.

To confirm the post-dredge sediment z-layer chemical concentrations, six sub-surface sediment cores will be collected within the in-water portion of the RAB as shown in Figure 2. Additional material below the 0- to 1-foot sample interval may be archived by the Owner for potential future data evaluation needs. As described in Section 5.4.3.1, sediment z-layer sample collection will be attempted prior to backfill placement, if possible. If backfill has been placed prior to z-layer sample collection, core samples will be collected through the backfill to facilitate sampling of the 0- to 1-foot z-layer below the backfill material.

EPA has acknowledged that the removal action activities may result in a thin layer of sediments with residual total PCB concentrations deposited on the final post-dredge surface. Because of this acknowledgement, coupled with the extensive surface and subsurface data collected within the RAB, EPA approved (EPA 2011b) the Final EE/CA (Anchor QEA 2011) condition that the results of any post-dredge sampling and analysis would not trigger any further remedial actions unless the area weighted concentrations in the RAB are greater than 20 times the RvAL or 240 milligrams per kilogram normalized for organic carbon. In this situation, further evaluation would be required and these data would be used to document that the surface backfill concentrations in this area(s) remain protective of human health and the environment based on the surface weighted average concentrations in the RAB.

5.3.1.2 Post-excavation Shoreline Bank Z-layer Monitoring

Post-excavation z-layer shoreline bank samples will be collected from the 0- to 1-foot interval to document the nature of the shoreline material beneath the backfill area. A total of six samples will be collected between the mean higher high water (MHHW) elevation (11 feet mean lower low water [MLLW]) and the top of bank (approximately 19 to 20 feet MLLW) as shown on Figure 2. In accordance with Comment No. 2 in a letter from EPA dated January 22, 2013, "sample results will not compel future remediation events under the existing AOC." The shoreline bank z-layer samples will be collected prior to shoreline bank armor placement.

5.3.1.3 Perimeter Surface Sediment Monitoring

Pre- and post-construction perimeter surface sediment samples will be collected to evaluate whether there are significant increases in concentrations of chemicals of concern (COCs) in surface sediments adjacent to the RAB relative to their pre-remediation concentrations due to releases from the construction activities. Consistent with Ecology Sediment Management Standards (SMS), the depth for the surface sediment samples will be the top 10 centimeters (cm) below mudline.

To better assess the potential contributions from removal action construction releases versus off-site sources, samples will be collected in an area directly adjacent to the RAB as well as an upstream area outside the influence of the construction, as shown on Figure 3. A total of six discrete samples will be collected from each of these areas and submitted for chemical analysis as described in Section 5.3.3.

Boeing Plant 2 Duwamish Sediment Other Area (DSOA) cleanup action is located directly downstream of the RAB. Active cleanup of the portion of the DSOA in the vicinity of the RAB is anticipated to begin expeditiously following completion of the removal action performed by the Owner. Boeing is expected to implement a separate perimeter monitoring plan to address potential releases from the DSOA removal activity as described in the Pre- and Post-Construction Perimeter Sediment Monitoring Plan (AMEC 2012). Therefore, no perimeter monitoring downstream of the RAB is proposed in this CQAP.

Post-construction perimeter surface sediment sampling will be conducted concurrently with additional Year 0 surface sediment monitoring within the RAB as described in the Operations, Maintenance, and Monitoring Plan (OMMP; Appendix F to the BODR) and will serve as a baseline condition for future long-term monitoring.

5.3.2 Monitoring Methods, Locations, and Timing

A brief summary of the monitoring methods, locations, and timing is provided in the following subsections. Detailed procedures for subsurface and surface sediment and soil sampling are provided in the Field Sampling Plan (FSP) for this project (see Attachment 2 of Appendix I to the BODR). Detailed field and laboratory quality assurance and quality control criteria, including method specifications, detection limits, accuracy and precision requirements, are provided in the Quality Assurance Project Plan (QAPP) for this project (see Attachment 1 of Appendix I to the BODR).

5.3.2.1 Sampling Methods

5.3.2.1.1 Post-dredge Sediment Z-layer Monitoring

The post-dredge sediment z-layer samples will be collected from the 0- to 1-foot interval using a van Veen grab sampler or equivalent deployed from a winch line on a sampling vessel if the sampling is conducted prior to backfill placement. If the sampling is conducted following backfill placement, the subsurface (0- to 1-foot layer beneath the backfill) z-layer samples will be collected using a MudMole™ coring device or similar deployed from a winch line on a sampling vessel. Cores would be advanced to a minimum depth of 3 feet below the bottom of the backfill, or until refusal. Additional material deeper than the 0- to 1-foot interval may be archived for future data evaluation needs. A detailed summary of the sampling methods is provided in Attachment 2 of Appendix I in the BODR.

5.3.2.1.2 Post-excavation Shoreline Bank Z-layer Monitoring

The post-excavation shoreline bank z-layer samples will be collected from the 0- to 1-foot interval by hand-collection methods. If hand collection of samples is not possible due to debris or hard substrate, more robust sampling equipment will be used as necessary to collect the samples. All samples will be collected prior to shoreline armor layer placement.

Additional material deeper than the 0- to 1-foot interval may be archived for future data evaluation needs. A detailed summary of the sampling methods is provided in Attachment 2 of Appendix I in the BODR.

5.3.2.1.3 Perimeter Surface Sediment Monitoring

Perimeter surface sediment monitoring samples will be collected using a van Veen grab sampler or equivalent deployed from a winch line on a sampling vessel. All grab samples will be collected from the top 10 cm of the sediments. A detailed summary of the sampling methods is provided in Attachment 2 of Appendix I in the BODR.

5.3.2.2 Sampling Locations

5.3.2.2.1 Post-dredge Sediment Z-layer Monitoring

The six proposed post-dredge sediment z-layer sample locations are shown in Figure 2. The locations are distributed to achieve spatial coverage and target areas with the highest surface and subsurface PCB concentrations (see Figure 7 of the BODR). The sample coordinates for each sediment core location are listed in Table 1.

5.3.2.2.2 Post-excavation Shoreline Bank Z-layer Monitoring

The six proposed post-excavation shoreline bank z-layer sample locations are shown in Figure 2. Soil sample locations are spatially distributed along the bank and in target areas with relatively high PCB concentrations shown on Figure 2. Bank soil sample location PEB-1 specifically documents the post-excavation material within the property line storm pipe outfall removal action described in Section 2.2.2.1 of the BODR. The samples will be collected between the MHHW elevation (11 feet MLLW) and the top of bank (approximately 19 to 20 feet MLLW) as shown on Figure 2. The sample coordinates for each bank sample are listed in Table 1. Actual sample locations may need to be adjusted as necessary to collect samples of the post-excavation material within the target elevation range.

5.3.2.2.3 Perimeter Surface Sediment Monitoring

The proposed perimeter surface sediment sample locations are shown on Figure 2. Surface sediment grab samples are systematically distributed within two different monitoring areas, including the adjacent Federal Navigation Channel area and one upstream area.

Six sediment grab samples will be collected from both the adjacent area and the upstream area. The 12 samples will be collected for the chemical analyses described in Section 5.3.3. The sample coordinates for each of the sediment grab sample locations are listed in Table 1.

5.3.3 Chemical Analytical Parameters

The post-dredge sediment z-layer samples (six samples) and the perimeter surface sediment monitoring samples (12 samples) will be submitted for analysis of the following parameters:

- Total PCB Aroclors
- Total organic carbon
- Metals (i.e., arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc)
- Total solids
- Grain size

As described in the EE/CA (Anchor QEA 2011), these COCs are consistent with the COCs identified within the RAB at elevated concentrations.

Post-excavation shoreline bank z-layer samples (six total samples) will be submitted for analysis of the full list of SMS analytes provided in Table 2.

5.3.4 Monitoring Timing

5.3.4.1 Post-dredge Sediment Z-layer Monitoring

Post-dredge sediment z-layer samples will be collected at the locations shown in Figure 2 after the completion of dredging and, if possible, prior to interim backfill placement (dependent on final construction sequencing). If the samples are collected prior to backfill placement, backfill material may be placed immediately following sampling (i.e., backfill placement is not affected by the z-layer analytical results).

5.3.4.2 Post-excavation Shoreline Bank Z-layer Monitoring

Post-excavation bank monitoring samples will be collected at the locations shown in Figure 2 after completion of excavation and before placement of the shoreline bank armor layers.

5.3.4.3 Perimeter Surface Sediment Monitoring

Perimeter surface sediment monitoring will be performed both prior to the initiation of removal action construction activities as well as immediately following completion of the dredging and backfill placement activities. Pre-construction grab samples will be collected at the locations shown in Figure 3 prior to the start of any construction activities. Post-construction grab samples will be collected from the locations shown in Figure 3 as soon as possible after backfill placement to the final grade is complete.

Additional surface sediment monitoring of sediments adjacent to the RAB may be performed during active remediation contingent upon removal activity by other LDW parties, concurrent with construction.

6 DOCUMENTATION AND REPORTING

Documentation and reporting for CQA activities will include pre-construction documentation, construction documentation, and post-construction documentation as detailed below. The Contractor and the CQAO will work closely on a daily basis during the removal action to complete the project as specified in the EPA-approved design documents and to collect the documentation required. The following sections describe documentation that will be required throughout the removal action.

6.1 Pre-Construction Documentation

The Contractor will be required to submit a Removal Action Work Plan (RAWP) for approval by the Owner and EPA. The RAWP will contain the following elements:

- Project Work Plan
- CQC Plan
- Construction Health and Safety Plan
- Construction Environmental Protection Plan (EPP)
- Project Construction Schedule
- Survey Control Plan
- Procedures for processing design changes and securing EPA review and approval of such changes to ensure changes are consistent with the objectives of the EPA-approved design documents
- Procedures for coordinating with EPA regarding compliance with EPA's Off-Site Rule, as applicable

EPA's approval authority for these plans is defined in the AOC. CQA and CQC procedures will be addressed in various elements of the RAWP. A brief description of the contents of each plan component of the RAWP is provided below.

6.1.1 Project Work Plan

The Project Work Plan will describe, in narrative form, the methods to be employed in the removal action including equipment types, modes of operation, schedules, sequence of activities, and other aspects necessary to describe how and when the specified work will be

performed. The Project Work Plan will have specific sections detailing how the following elements will be completed:

- Dredging and shoreline reconfiguration
- Backfill and armor layer placement

The Project Work Plan will describe how each of the quality assurance measures and verification activities identified in Section 5 will be addressed in the field.

6.1.2 Construction Quality Control Plan

The CQC Plan will present the system through which the Contractor ensures that construction activities are being implemented in compliance with the requirements of the contract and specifically how each of the quality assurance measures and verification activities identified in Section 5 will be addressed in the field. The CQC Plan will identify personnel, procedures, methods, instructions, inspections, records, and forms to be used in the CQC system. Specifically, the CQC Plan will include a description of procedures for maintaining and updating daily activity logs, procedures for reporting out-of-spec conditions, recordkeeping procedures for personnel, equipment maintenance and calibration, and daily and weekly reporting requirements.

6.1.3 Construction Health and Safety Plan

The Contractor will submit its CHASP presenting the necessary health and safety requirements for job site activities, and the measures and procedures to be employed for protection of on-site personnel. The plan will cover the controls, work practices, personal protective equipment (PPE), and other health and safety requirements that will be implemented by the Contractor in connection with the removal action construction activities. The Contractor shall use personnel that are trained to maintain the necessary health and safety protocols for this type of cleanup work.

6.1.4 Construction Environmental Protection Plan

The Contractor will be required to submit an EPP describing the environmental protection measures and monitoring activities that will accompany all construction activities. The EPP

will cover potential environmental releases as a result of the Contractor operations, as well as monitoring and corrective actions necessary to control such releases. The EPP will contain separate sections addressing contamination prevention, containment and cleanup, erosion and turbidity control, sound level control, air pollution and dust control, and water quality monitoring as they pertain to the pertinent construction activities described in Section 5.

6.1.5 Project Construction Schedule

A detailed Project Construction Schedule will be submitted by the Contractor for each construction element prior to construction. Periodic schedule updates will be submitted by the Contractor following progress meetings.

6.1.6 Survey Control Plan

The Contractor will submit a Survey Control Plan prior to construction. The plan will detail the specific procedures, equipment, and personnel to be used for all landside and in-water surveying work. The plan will also discuss the quality assurance and quality control measures to confirm surveying results.

6.2 Construction Documentation

During construction activities, the Contractor will be required to provide a variety of documentation to the CQAO, including testing results of materials received, weigh tickets for shipments of materials removed, survey results, and documentation of pay items completed. The Contractor will also maintain a daily log of activities, as described in Section 6.2.1. The CQAO will maintain a field report of daily activity and complete an internal weekly report. The contents of the report are described in Section 6.2.2. Weekly progress reports will be submitted to EPA. Additional documentation is described in Sections 6.2.3 through 6.2.6. The records described in this section will be maintained in the project files. Monitoring data will be provided electronically to EPA in the Removal Action Completion Report (RACR).

All final construction documentation will be stamped, as appropriate, by licensed professionals. If, during the course of construction, modification of the final stamped and approved design is required, modifications will be documented in writing and stamped by a

licensed engineer. Undocumented modifications of the design or other deviations from the approved design will not be permitted. Construction surveys, including as-built surveys, will be documented on drawings using the same datum, unit, and scale as design drawings. Record drawings will allow for a direct visual assessment of the quality and completeness of construction.

6.2.1 Contractor's Daily Quality Control Report

During construction activities, the Contractor shall prepare a Daily Quality Control Report and submit it to the CQAO. The Contractor's daily report will record at a minimum:

- Identification of personnel on-site and appropriate professional certifications
- Activities completed
- Any changes to best management practices or environmental controls
- Materials delivered or used
- Equipment used
- Hours worked
- Materials dredged and disposed of off-site
- Debris removed and disposed of off-site
- Surveys completed
- Results of any quality control inspections, tests, or other monitoring activities
- On-site/ off-site loading facility activities
- Problems encountered and resolution of problems
- Any EPA-authorized deviations from the Final Design

The Daily Quality Control Reports will be sent to EPA on a weekly basis as part of the Weekly Summary Report as discussed in Section 6.2.3.

6.2.2 Construction Quality Assurance Officer's Daily Report

The CQAO will maintain a daily field log to record observations, measurements, inspections completed, data received, communications with other members of the project team or EPA, any water quality exceedances, additional environmental controls that were implemented, problems encountered, and resolutions. The daily field log will be supported by submittals received from the Contractor, such as survey results and weigh tickets, chain of custody

forms for water quality monitoring samples collected, laboratory data received, inspection reports, and written communication from members of the project team or EPA. Water quality results will also be separately recorded and reported as defined in the Water Quality Monitoring Plan (WQMP; Appendix E of the BODR).

6.2.3 Weekly Summary Reports

The CQAO, in cooperation with the Contractor, will prepare weekly summaries of progress. These summaries will facilitate the preparation of the Weekly Summary Reports. The Weekly Summary Report will identify progress organized by activity:

- Dredging and Shoreline Reconfiguration
  - Area worked (supported by Contractor's log)
  - Volume of material removed (supported by Contractor's log)
  - Surveys completed (supported by Contractor's log)
  - Problems encountered
  - Corrective actions
- Backfill and Shoreline Armor Placement
  - Area worked (supported by Contractor's log)
  - Weight/volume of material placed
  - Problems encountered
  - Corrective actions
- Environmental Controls
  - Samples collected
  - Summary of analytical results
  - Problems encountered
  - Corrective actions

6.2.4 Weekly Construction Meetings

Weekly progress meetings will be coordinated with EPA and its partner agencies including pre-notification of time and place of meetings. Conference call access will be provided as needed and requested by those agencies and meeting minutes will be prepared and made available to attendees. As part of ongoing coordination efforts with Boeing, the Owner will

determine if and when Boeing representatives should be invited to attend the weekly meetings.

6.2.5 Import Material Characterization

Prior to any on-site placement of import materials, the Contractor shall submit a Borrow Site Characterization Report to the CQAO. The characterization report will include identification of the source (including a map documenting the origin of the material), site inspection, and material sample and characterization (physical and chemical testing, as specified) to ensure that the import material will uniformly meet the chemical and physical specifications of its intended use.

6.2.6 Post-Construction Documentation

Within 90 days of EPA confirmation that all of the removal action requirements have been fulfilled (excluding long-term post-construction monitoring requirements), the Owner will submit a Draft RACR. The Draft RACR will contain the following information:

- Introduction
  - Site location
  - Environmental setting
  - Relevant operational history
  - Summary of previous investigations and actions
- Removal Action Background
  - Basis for the removal action (i.e., the AOC)
  - Context within overall LDW Superfund Site
  - RAOs
  - Summary of design basis
  - Summary of deviations from the design, if any
- Construction Activities
  - Description of dredging activities
  - Description of shoreline bank reconfiguration
  - Description of backfill and armor placement

  - Description of transport, offloading and offsite disposal
  - Description of construction monitoring activities
  - Description of completion and demobilization

- Chronology of Events
  - Description of the timing of construction activities, identifying milestones with reference to a tabular summary of a more detailed construction timeline

- Performance Standards and CQC
  - Description of performance objectives and verification activities performed to confirm the removal action was implemented in accordance with the Construction Specifications and Drawings
  - Description of actual construction performance relative to performance objectives, including a summary of the results of CQA measurements and analyses
  - Description of contingency actions implemented, if any were necessary
  - Description of EPA's oversight activities
  - Summary of z-layer sampling and perimeter monitoring results
  - (Note: quality assurance for water quality monitoring analytical data will be included in the Final Water Quality Monitoring Report)

- Final Inspection and Certifications
  - Description of final inspections, including the scope of inspections and noting any deficiencies identified and corrective actions implemented
  - Summary of health and safety monitoring during the implementation of the removal action with notation of deviations or incidents, if applicable
  - Identification of any institutional or engineering controls that are implemented to maintain the integrity of the removal action, including identification of parties responsible for maintaining and enforcing controls
  - If applicable, summary of close out requirements for off-site offloading facility

- Operation and Maintenance Activities
  - Description of post-construction monitoring and maintenance requirements
  - Description of contingency measures that would be implemented if post-construction monitoring indicates such measures are warranted

- Summary of Project Costs
  - Identification of the actual final costs incurred to comply with the provisions of the AOC
  - Identification of costs previously estimated for implementation of the removal action and an update of the cost estimate for post-construction monitoring and maintenance costs
- Observations and Lessons Learned
  - Identification of problems encountered, if any, in implementing the removal action and corrective actions
  - Identification of successes in implementing the removal action
  - Analysis of lessons learned that may be applied to future activities
- Removal Action Contact Information
  - Identification of individuals (contact names, addresses, and phone numbers) for design and remediation contractors, EPA oversight contractors, and key personnel at the Owner, EPA, and other agencies

The RACR will also include copies of as-built drawings, summaries of waste disposal and analytical results, the Final Water Quality Monitoring Report, and the certification statement required by the AOC.

If applicable, the Owner will submit a Final RACR within 60 day of receipt of EPA comments on the Draft RACR.

7 REFERENCES

AMEC, 2012. *Pre- and Post-Construction Perimeter Sediment Monitoring Plan. Duwamish Sediment Other Area and Southwest Bank Corrective Measure and Habitat Project, Boeing Plant 2, Seattle/Tukwila, Washington*. May 2012.

Anchor QEA, 2011. *Final Engineering Evaluation/Cost Analysis – Jorgensen Forge Facility, 8531 East Marginal Way South, Seattle, Washington*. Prepared for the U.S. Environmental Protection Agency. March 2011.

EPA (U.S. Environmental Protection Agency), 2011a. Action Memorandum for a Non-Time-Critical Removal Action at the Jorgensen Forge Early Action Area of the Lower Duwamish Waterway Superfund Site in Seattle, Washington. Seattle, Washington.

EPA, 2011b. Letter from Shawn Blocker, EPA, to Gil Leon and Peter Jewitt. Re: Conditional Approval with Modifications of the Final Engineering Evaluation/Cost Analysis, Jorgensen Forge Facility, 8531 E. Marginal Way South, Seattle, Washington, Comprehensive Environmental Response, Compensation, and Liability Act Administrative Order On Consent (EPA Docket No. CERCLA-10-2003-01). September 29, 2011.

EPA, 2013. Letter from Rebecca Chu, EPA, to Gil Leon and Peter Jewitt. Re: Comments on the Draft Basis of Design Report, Jorgensen Forge Early Action Area, November 2012. January 22, 2013.

TABLES

Table 1
Sediment Sampling Station Coordinates

Sediment Monitoring Area		Station ID	Northing	Easting
Post-Dredge Z-Layer Monitoring		PDS-1	1275835.7	195628.2
		PDS-2	1275850.7	195510.5
		PDS-3	1275895.3	195460.8
		PDS-4	1275867.2	195315.2
		PDS-5	1275947.9	195369.4
		PDS-6	1275929.0	195180.7
Post Excavation Bank A-Layer Monitoring		PEB-1	1275796.0	195785.1
		PEB-2	1275831.7	195730.0
		PEB-3	1275863.1	195679.0
		PEB-4	1275905.8	195567.9
		PEB-5	1275947.2	195461.6
		PEB-6	1275977.2	195385.6
Perimeter Surface Sediment Monitoring	Upstream	PMU-1	1275966.1	195048.1
		PMU-2	1276023.2	195050.7
		PMU-3	1276036.5	194766.3
		PMU-4	1276116.1	194768.4
		PMU-5	1276136.4	194395.6
		PMU-6	1276219.3	194412.7
	Navigation Channel	PMN-1	1275774.8	195556.9
		PMN-2	1275826.8	195386.5
		PMN-3	1275860.4	195216.3
		PMN-4	1275852.9	195070.9
		PMN-5	1275941.8	194756.9
		PMN-6	1276033.0	194371.4

Note:

Horizontal Datum: WA SP NAD 83, North Zone, U.S. Feet

Table 2
Sediment Management Standards List of Analytes

Parameter	Analytical Method	Units	Ecology 2003 Freshwater Criteria[d]		Sediment Management Standards Criteria[d]		SAPA Recommended Practical Quantitation Limit (PQL)[b]	Laboratory PQL
			LAET	2LAET	Sediment Quality Standards	Cleanup Screening Level		
Conventional Parameters								
Grain size	PSEP, 1986	%	--	--	--	--	1	1.0
Total solids	PSEP, 1986	% wet wt	--	--	--	--	0.1	0.01
Total organic carbon (TOC)	PSEP, 1986	% dry wt	--	--	--	--	0.1	0.05
Total sulfides	PSEP, 1986	% dry wt	--	--	--	--	10	1.0
Ammonia	Plumb, 1981	mg-N/kg dry wt	--	--	--	--	100	1.0
Metals								
Arsenic	6010B/6020	mg/kg dry wt	31.4	50.9	57	93	19	0.2
Cadmium	6010B/6020	mg/kg dry wt	2.39	2.9	5.1	6.7	1.7	0.2
Chromium	6010B/6020	mg/kg dry wt	95	133	260	270	87	0.5
Copper	6010B/6020	mg/kg dry wt	619	829	390	390	130	0.5
Lead	6010B/6020	mg/kg dry wt	335	431	450	530	150	0.2
Mercury	7471A	mg/kg dry wt	0.8	3.04	0.41	0.59	0.14	0.025
Silver	6010B/6020	mg/kg dry wt	0.545	3.5	6.1	6.1	2	0.2
Zinc	6010B/6020	mg/kg dry wt	683	1080	410	960	137	4.0
SVOCs								
PAHs								
Total LPAH	8270D	µg/kg dry wt	6,590	9,200	370 mg/kg OC	780 mg/kg OC	--	--
Naphthalene	8270D	µg/kg dry wt	529	1,310	99 mg/kg OC	170 mg/kg OC	700	20
Acenaphthylene	8270D	µg/kg dry wt	470	640	66 mg/kg OC	66 mg/kg OC	433	20
Acenaphthene	8270D	µg/kg dry wt	1,060	1,320	16 mg/kg OC	57 mg/kg OC	167	20
Fluorene	8270D	µg/kg dry wt	1,070	3,850	23 mg/kg OC	79 mg/kg OC	180	20
Phenanthrene	8270D	µg/kg dry wt	6,100	7,570	100 mg/kg OC	480 mg/kg OC	500	20
Anthracene	8270D	µg/kg dry wt	1,230	1,580	220 mg/kg OC	1,200 mg/kg OC	320	20
2-Methylnaphthalene[a]	8270D	µg/kg dry wt	469	555	38 mg/kg OC	64 mg/kg OC	223	20
Total HPAHs	8270D	µg/kg dry wt	31,640	54,800	960 mg/kg OC	5,300 mg/kg OC	--	--
Fluoranthene	8270D	µg/kg dry wt	11,100	15,000	160 mg/kg OC	1,200 mg/kg OC	567	20
Pyrene	8270D	µg/kg dry wt	8,790	16,000	1,000 mg/kg OC	1,400 mg/kg OC	867	20
Benzo(a)anthracene	8270D	µg/kg dry wt	4,260	5,800	110 mg/kg OC	270 mg/kg OC	433	20
Chrysene	8270D	µg/kg dry wt	5,940	6,400	110 mg/kg OC	460 mg/kg OC	467	20
Total benzo(b+k)fluoranthenes	8270D	µg/kg dry wt	11,000	13,800	230 mg/kg OC	450 mg/kg OC	1,067	20
Benzo(a)pyrene	8270D	µg/kg dry wt	3,300	4,810	99 mg/kg OC	210 mg/kg OC	533	20
Indeno(1,2,3-cd)pyrene	8270D	µg/kg dry wt	4,120	5,300	34 mg/kg OC	88 mg/kg OC	200	20
Dibenz(a,h)anthracene	8270D	µg/kg dry wt	800	839	12 mg/kg OC	33 mg/kg OC	77	20
Benzo(g,h,i)perylene	8270D	µg/kg dry wt	4,020	5,200	31 mg/kg OC	78 mg/kg OC	223	20
Chlorinated Benzenes								
1,2-Dichlorobenzene	8260C	µg/kg dry wt	--	--	2.3 mg/kg OC	2.3 mg/kg OC	35	1.0
1,4-Dichlorobenzene	8260C	µg/kg dry wt	--	--	3.1 mg/kg OC	9 mg/kg OC	37	1.0
1,2,4-Trichlorobenzene	8260C	µg/kg dry wt	--	--	0.81 mg/kg OC	1.8 mg/kg OC	31	5.0
Hexachlorobenzene	8081A	µg/kg dry wt	--	--	0.38 mg/kg OC	2.3 mg/kg OC	22	1.0
Phthalates								
Dimethyl phthalate	8270D	µg/kg dry wt	311	436	53 mg/kg OC	53 mg/kg OC	24	20
Diethyl phthalate	8270D	µg/kg dry wt	--	--	61 mg/kg OC	110 mg/kg OC	67	20
Di-n-butyl phthalate	8270D	µg/kg dry wt	103	--	220 mg/kg OC	1,700 mg/kg OC	467	20
Butyl benzyl phthalate	8270D	µg/kg dry wt	260	366	4.9 mg/kg OC	64 mg/kg OC	21	20
Bis(2-ethylhexyl) phthalate	8270D	µg/kg dry wt	2,520	6,380	47 mg/kg OC	78 mg/kg OC	433	20
Di-n-octyl phthalate	8270D	µg/kg dry wt	11	201	58 mg/kg OC	4,500 mg/kg OC	2,067	20
Miscellaneous Extractables								
Dibenzofuran	8270D	µg/kg dry wt	399	443	15 mg/kg OC	58 mg/kg OC	180	20
Hexachlorobutadiene	8081A	µg/kg dry wt	--	--	3.9 mg/kg OC	6.2 mg/kg OC	11	1.0
N-Nitrosodiphenylamine	8270D	µg/kg dry wt	--	--	11 mg/kg OC	11 mg/kg OC	28	20
Ionizable Organic Compounds								
Phenol	8270D	µg/kg dry wt	--	--	420	1,200	140	20
2-Methylphenol	8270D	µg/kg dry wt	--	--	63	63	63	20
4-Methylphenol	8270D	µg/kg dry wt	760	2,360	670	670	223	20
2,4-Dimethylphenol	8270D	µg/kg dry wt	--	--	29	29	29	20
Pentachlorophenol	8270D	µg/kg dry wt	--	--	360	690	120	100
Benzyl Alcohol	8270D	µg/kg dry wt	--	--	57	73	57	100
Benzoic Acid	8270D	µg/kg dry wt	2,910	3790	650	650	217	200
PCBs								
Total PCB Aroclors	8082	µg/kg dry wt	62	354	12 mg/kg OC	65 mg/kg OC	6	10

Notes:

a - 2-Methylnapthalene is not included in the sum of LPAHs

b - Washington State Department of Ecology Sediment Sampling and Analysis Plan Appendix, February 2008

c - TEQs will be calculated using WHO 2005 Mammalian TEFs with ND=DL, EMPC=EMPC & ND=DL/2, EMPC=EMPC

d - Units designated with "OC" are TOC normalized per SMS guidance; however, TOC values <0.5% or >3% will be not be OC normalized and screened against LAET and 2LAET criteria

µg/kg = microgram per kilogram

mg/kg = milligram per kilogram

HPAH = high-molecular-weight polycyclic aromatic hydrocarbon

LAET = lowest apparent effects threshold

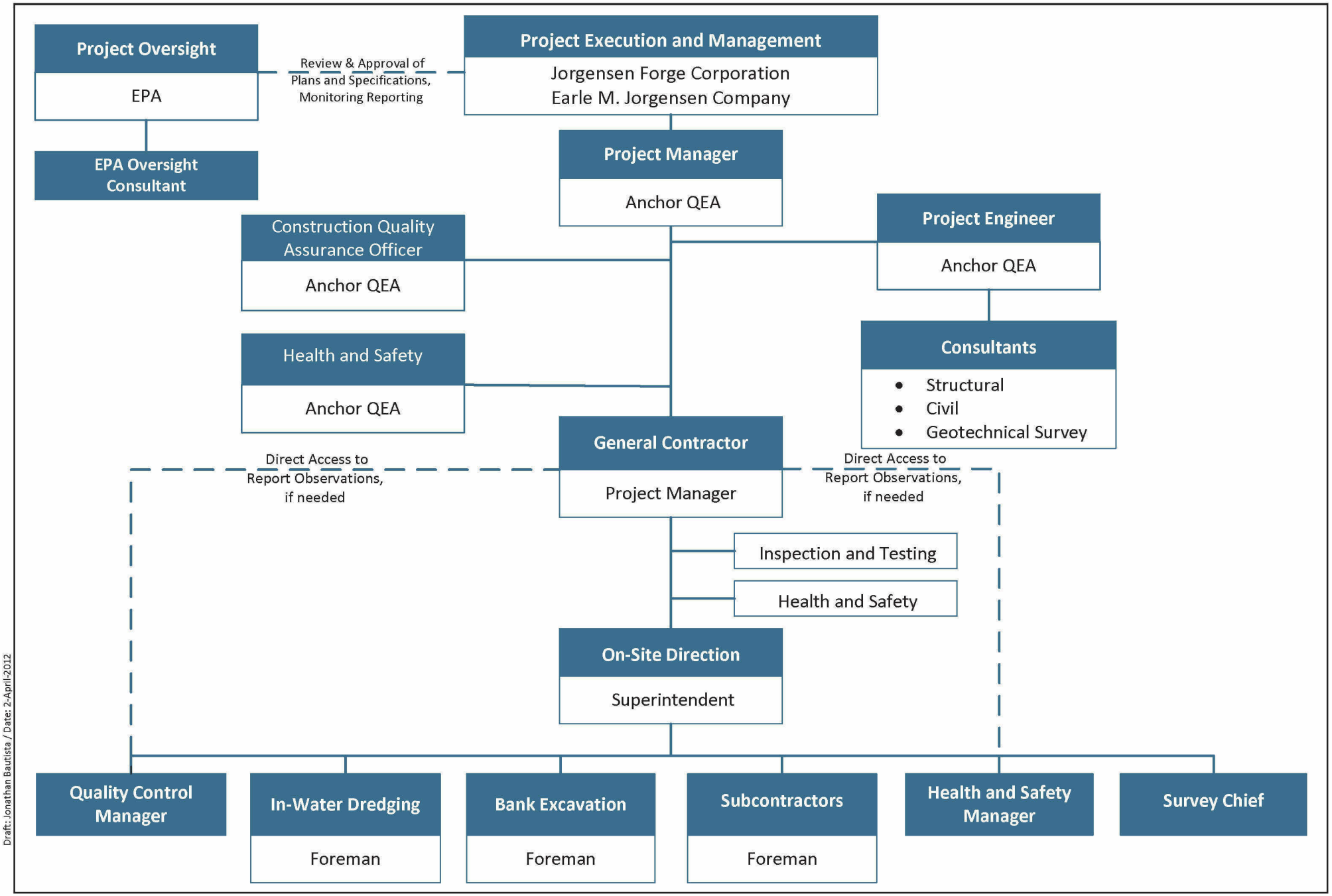
2LAET = second lowest apparent effects threshold

LPAH = low-molecular-weight polycyclic aromatic hydrocarbon

PQL = Practical Quantitation Limits

SSAPA = Sediment Sampling and Analysis Plan Appendix (Washington State Department of Ecology, 2008. *Sediment Sampling and Analysis Plan Appendix*. Ecology Publication No. 03-09-043. February 2008).

FIGURES

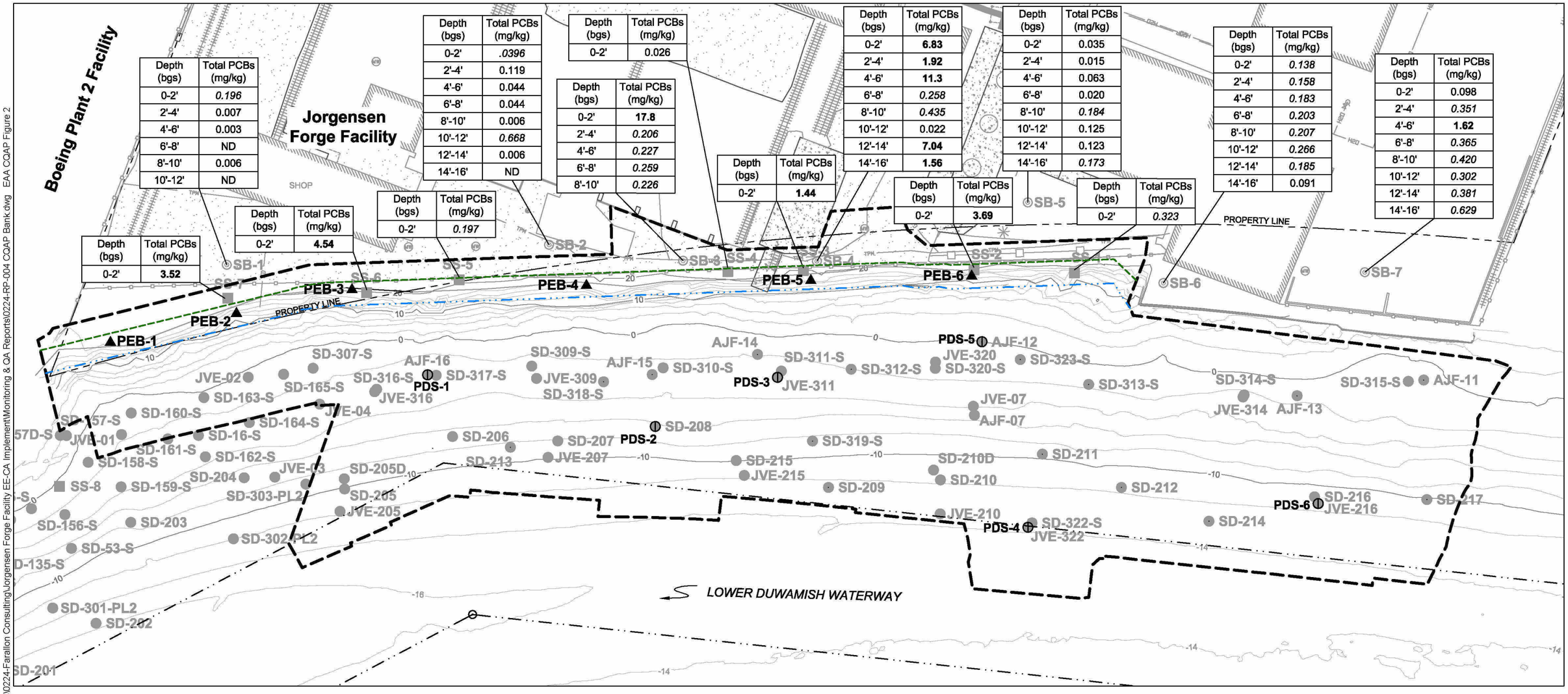


Draft: Jonathan Bautista / Date: 2-April-2012

ANCHOR QEA

Figure 1
Organizational Chart
Construction Quality Assurance Plan
Jorgensen Forge Early Action Area

EMJ015195



HORIZONTAL DATUM: Washington State Plane North, NAD83.
VERTICAL DATUM: Mean Lower Low Water (MLLW).

DATA BOX NOTES:

1. '*Italic*' text indicates concentrations above the sediment management standards Lowest Apparent Effect Threshold (LAET) screening level.
2. '**Bold**' text indicates concentrations above the sediment management standards 2 LAET screening level.
3. Sediment z-layer confirmation samples will be collected from the 0- to 1-foot interval of the post-dredge surface. Samples may be collected either before (surface grab) or following placement (subsurface core). The timing and methods will be determined based on the construction sequencing.
4. Shoreline bank z-layer surface grab confirmation samples will be collected from the 0- to 1-foot interval of the post-excavation surface.

LEGEND:

- Navigation Channel
- Existing Bathymetry (2 ft interval)
- Existing Fence Line
- Dredge/Excavation Limits
- Post-Construction +11 ft Elevation Contour, Mean Higher High Water
- Post-Construction +17 ft Elevation Contour
- (bgs) Below Ground Surface
- (mg/kg) Milligram per Kilogram
- PDS-1 Proposed Sediment Z-Layer Confirmation Sample
- PEB-6 Proposed Shoreline Bank Z-Layer Confirmation Sample
- SB-1 Existing Soil Boring Sample
- SS-5 Existing Surface Soil Sample
- SD-207 Existing Subsurface Sediment Sample

0 50
Scale in Feet

K:\Projects\0224-Farallon Consulting\Jorgensen Forge Facility EE-CA Implementation\Monitoring & QA Reports\0224-RP-004 CQAP Bank.dwg EAA CQAP Figure 2
Mar 25, 2013 2:53pm chewett

ANCHOR QEA

Figure 2
Sediment and Shoreline Bank Post-Removal Z-Layer Confirmation Station Locations
Construction Quality Assurance Plan
Jorgensen Forge Early Action Area

EMJ015196

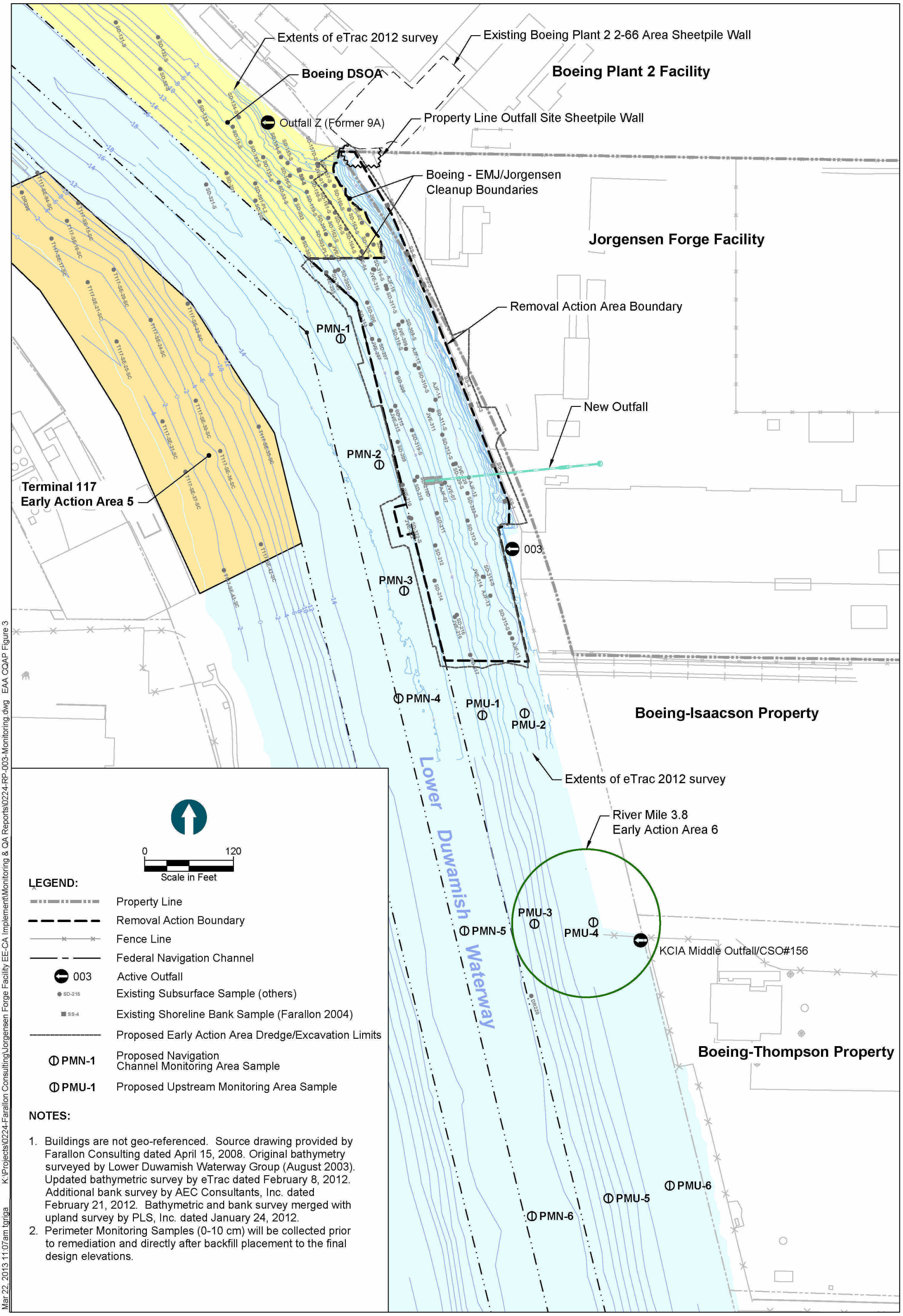


Figure 3
Sediment Perimeter Monitoring Station Locations
Construction Quality Assurance Plan
Jorgensen Forge Early Action Area

ANCHOR QEA

EMJ015197